

Description of a new species of *Drupa* Röding, 1798 (Gastropoda: Muricidae: Rapaninae) from the Western Indian Ocean

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ABSTRACT. *Drupa denticulata* n.sp. is described. The species is restricted to Northeast Madagascar and to Réunion, and is compared with *Drupa morum morum* (Röding, 1798) from the Indo-West Pacific and *Drupa morum iodostoma* (Lesson, 1840), a subspecies endemic to the Marquesas Islands (French Polynesia).

RESUME. Une nouvelle espèce, *Drupa denticulata* n.sp. est décrite de la Réunion et de Madagascar. Elle est comparée à *Drupa morum morum* Röding, 1798 de l'Indo-Pacifique et à *Drupa morum iodostoma* une sous-espèce endémique aux Iles Marquises (Polynésie Française).

INTRODUCTION

This paper is the result of many comparisons of *Drupa* species during the last 20 years or so. Apart from the study material listed many unlisted lots were examined in private and museum collections. *Drupa denticulata* n.sp. resembles *D. morum morum* (Röding, 1798), a more globose and more nodose species, with which it is probably sympatric at Madagascar and Réunion, and its subspecies *D. morum iodostoma* (Lesson, 1840). The genus *Drupa* was revised by EMERSON & CERNOHORSKY (1973).

The distinction between the two species uses basically the methods of the statistical inference to

establish the discrimination level of the studied measures.

MATERIAL AND METHODS

Measurements

The following measurements have been used:

a: Length of the shell, parallel to the axis, from the apex to the extremity of the siphonal canal.

b: Largest breadth, including knobs.

c: Height of two adapical groups of outer apertural denticles.

d: Height of columellar folds.

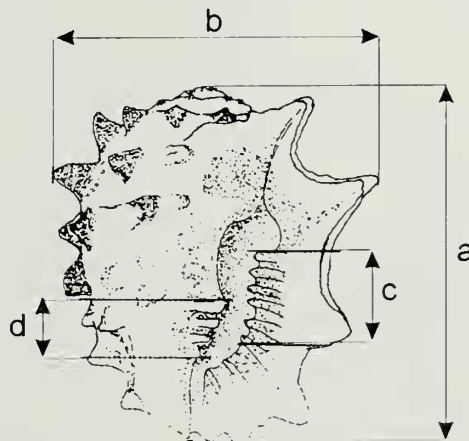


Fig. 1. Shell measurements for *Drupa*

To describe the distribution of the three ratios b/a, c/a and d/a for the two samples, two and three dimensional graphiucs (scatter diagrams) have been used.

The statistical study was made by using the hypothesis tests that investigate if the difference between the observed means for b/a, c/a and d/a are significative at a significance level of 5 or 1 percent.

The first test of means comparison was based on the sampling distribution of the means difference. The way to do this was the classical one.

The second test is based on a variance analysis, using the Fisher's distribution. A discriminant analysis was also carried out. These analysis, and the graphics corresponding, were built with the software SAS release 6.12 (ANOVA and CANDISC procedures).

Abbreviations

AMS: The Australian Museum, Sydney, Australia.

EPHE: Ecole Pratique des Hautes Etudes, Perpignan, France.

IRSNB: Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium.

JT: collection of Jean Tröndlé.

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

NM: Natal Museum, Pietermaritzburg, South Africa.

NMNZ: Museum of New Zealand, Wellington.

RH: collection of Roland Houart.

SYSTEMATIC ACCOUNT

GENUS : *Drupa* Röding, 1798

Type species by subsequent designation (Rovereto, 1899): *Drupa morum* Röding, 1798; Recent, Indo-West Pacific.

Drupa morum morum Röding, 1798

Fig. 6, table 1

Drupa morum Röding, 1798: 55, refers to Martini figs 972, 973.

Canrena neritoidea Link, 1807: 126, refers to Martini, restricted to figs 972, 973 by Cernorhorsky (1969).

Ricinula horrida Lamarck, 1816: 1, pl.395, figs 1a,b.

Ricinella violacea Schumacher, 1817: 240, refers to Martini figs 972, 973.

Ricinula globosa Mörch, 1852: 88, refers to Martini, figs 972, 973.

Material examined.

MADAGASCAR: MNHN (1); Taolagnaro (Fort

Dauphin) RH (15); Toliara (Tulear), RH (2); ca. 25 kms N of Toliara (Tulear), RH (2); Nosy Be, RH (2); REUNION: RH (1); coll. M. Jay (28); Saint Pierre, S coast, RH (2); Boucan Canot, W coast, RH (2); Baie de la Possession, NW coast, RH (2); Sainte Rose, E coast, RH (2); MAURITIUS: MNHN (1); SEYCHELLES: IRSNB IG 10591 (6); MNHN (5) (7); RED SEA: MNHN (3) (7), RH (1); Port Sudan, RH (1); THAILAND: Phuket, RH (1); Ko Phi Phi, RH (1); INDONESIA: Bay of Jakarta, IRSNB IG 10591 (2); South Java, IRSNB IG 10591 (6); Sanghiang Island, between Java and Sumatra, RH (2); Bali, RH (3); Bali, Samur, RH (1); Kai-Tioor, RH (2); Ambon, Leitumur, Baturerah, RMNH (1); Ambon, ca. 3-4 km NW of Hutumuri, RMNH (2); Ambon, Leitumur, Cape Nasaniwe, RMNH (10); Ambon, SE side of Pombo Island, RMNH (11) RH (2); Ambon, Leitumur, Latuhalat, RMNH (2); Ambon., Leitumur, Hutumuri, RMNH (5); Ambon, Hitu, S side Larike, RMNH (6); Papua, New Guinea, IRSNB IG 10591 (4); PAPUA NEW GUINEA: Hansa Bay, Laing Island, RH (1); PHILIPPINES: IRSNB IG 10591 (21), MNHN (1); TAIWAN: RH (2); JAPAN: Okinawa, RH (2); Japan, RH (3); Japan, Enoshima Beach, RH (1); SOLOMON IDS: IRSNB IG 10591 (7); AUSTRALIA: Queensland, Hastings Reef, RH (2); Queensland, Cairns, RH (2); North Queensland, Briggs Reef, RH (1); NEW CALEDONIA: MNHN (9) (4) (5) (2) (2); New Caledonia, IRSNB IG 10591 (3) (16); Lifou, IRSNB IG 10591 (1); Iles des Pins, IRSNB IG 10591 (4); FRENCH POLYNESIA: Society Archipelago, Mopelia IRSNB IG 10591 (17); Tahiti, IRSNB IG 10591 (3); Tuamotu Archipelago, Hikueru, IRSNB IG 10591 (3); Taenga, IRSNB IG 10591 (3); Rangiroa, RH (2); HAWAII: MNHN (7); RH (1); Hawaii, Hilo, IRSNB IG 10591 (2); Hawaii, Kalua-Kona, RH (3). FRENCH POLYNESIA [additional material listed by TRÖNDLÉ & HOUART (1992)]: Society Archipelago, Tahiti (EPHE, MNHN, JT), Moorea (EPHE, MNHN), Scilly (EPHE), Raiatea, Mopelia (MNHN); Tuamotu Archipelago: Takapoto (EPHE), Makemo, Fakahina, Napuka, Marokau, Tuanake, Motutunga, Hikureu, Fakarava, Hao, Amanu, Marutea (MNHN), Nukutavake (MNHN), Mururoa, Anaa (JT); Gambier: Taraouroa (MNHN), Mangareva (JT); Australes: Raevavae, Tubuai, Rurutu (EPHE); Rapa (EPHE).

Drupa morum iodostoma (Lesson, 1840)

Fig. 7

Purpura (Ricinula) iodostoma Lesson, 1840: 355

Material examined.

FRENCH POLYNESIA: Marquesas Ids: Ua Huka, Fatu Hiva, Tahuata (EPHE), Nuku Hiva (EPHE, JT, RH), Ua Pou (EPHE, RH), without any other locality data (MNHN). Listed by TRÖNDLÉ & HOUART (1992).

Drupa denticulata n.sp.

Figs 2-5, table 2

Type material.

Holotype IRSNB IG 28515/477, St. Pierre, Réunion; paratypes: 1 AMS C.203253; 1 MNHN; 1 NM L3580/T1462; 1 NMNZ M. 272616, Réunion; 1 RH, St. Denis, Réunion.

Other material examined.

Fort Dauphin (Taolagnaro, Northeast Madagascar), IRSNB IG 10591 (1); Réunion: RH (8), coll. M. Jay (5); St. Gilles-les-Bains, MNHN (1).

Description.

Shell medium sized for the genus, up to 39.3 mm high at maturity, rounded, heavy, weakly nodose, spire low. Protoconch unknown (eroded in all examined specimens). Teleoconch with up to 4 broad, rounded whorls, suture adpressed. Spiral sculpture of last whorl consisting of 3 adapical, high spiral rows of knobs and 2 low, smooth, abapical cords. First adapical row bordering suture, second delimiting shoulder, third on periphery. Additional spiral sculpture of low, broad, irregular cords.

Aperture narrow, elongate, about 60-70 % of total shell height. Columellar lip broad, callused, ornamented with 4 strong abapical folds and 1 or 2 lower folds just above siphonal canal. Anal notch deep, elongate. Outer lip with 2 groups of strong denticles: adapical group consisting of 4 denticles; abapical group of 2, 3 or occasionally 4 denticles; 2 weaker additional denticles near siphonal canal. Siphonal canal short,

open. White or greyish, knobs usually dark brown or black. Aperture purple with lighter coloured or white teeth and folds.

Discussion.

Drupa denticulata n.sp. resembles *D. morum morum* but has a smoother shell with three adapical spiral rows of knobs on the last teleoconch whorl, and two low, nearly obsolete abapical rows. In *D. morum morum* there are usually four high spiral rows of knobs, and one low abapical spiral row of knobs on last whorl. The shell of *D. denticulata* is narrower than *D. morum morum* relative to its total height, and the heights of the columellar folds and apertural denticles are greater relative to the total shell height (Fig. 1; Tables 1-2,). The apertural denticles are usually lower, and the columellar folds are broader in *D. denticulata* than in *D. morum morum*. The edge of the columellar lip is properly delimited in fully adult specimens of *D. denticulata*, and usually ornamented with a narrow, brown border. In all specimens of *D. morum morum* seen the margin of the columellar lip is irregular and not clearly delimited. *D. denticulata* is also smaller and the height is more regular (32-39 mm) than *D. morum morum*, which are commonly 28-46 mm in height.

Drupa morum iodostoma, a subspecies endemic to the Marquesas, has a broader shell with five low, smooth spiral cords on the last whorl. Its apertural features are identical to the nominal subspecies, but the colour is pinkish or violet instead of purple as in *D. morum morum*, and in *D. denticulata* n.sp.

Etymology.

denticulata (L): referring to its strong apertural teeth.

Locality	(a) mm	(b) mm	(c) mm	(d) mm
Réunion (Jay)	46.7	43.5	12.0	10.2
Réunion (Jay)	44.1	42.7	11.4	9.2
Ko Phi Phi, Thailand (RH)	42.5	41.2	12.4	9.9
Nosy Be, Madagascar (RH)	38.2	35.7	10.2	8.8
Nosy Be, Madagascar (RH)	37.9	36.4	10.2	9.3
Réunion (Jay)	36.8	35.9	10.8	8.7
Enoshima Beach, Japan (RH)	35.1	34.9	10.0	7.9
Tulear, Madagascar (RH)	34.6	33.1	8.8	6.9
St. Pierre, Réunion (RH)	34.2	34.0	9.7	7.7
Bali (RH)	33.0	30.0	8.7	6.0
Baie de la Possession, Réunion (RH)	32.7	30.3	9.0	7.1
Ste Rose, Réunion (RH)	32.1	30.0	9.1	7.7
Réunion (Jay)	31.6	30.3	8.0	6.2
Ambon, Indonesia (RH)	31.0	28.4	8.2	7.9
Baie de la Possession, Réunion (RH)	27.8	25.3	7.1	6.0

Table 1. Shell measurements for *Drupa morum morum* Röding, 1798

Locality	(a) mm	(b) mm	(c) mm	(d) mm
Réunion (RH)	39.3	28.8	11.0	9.8
Réunion (RH)	39.1	32.0	11.3	9.8
Réunion (RH)	38.6	34.3	11.6	11.4
Taolagnaro, NE Madagascar (IRSNB)	37.9	31.8	10.7	9.0
Réunion (Jay)	37.6	30.4	12.2	10.6
Réunion (Jay)	37.4	29.9	10.8	9.5
Réunion (Jay)	36.7	27.6	10.7	9.2
Réunion (Jay)	36.6	29.8	12.3	11.7
Réunion (paratype NMNZ)	36.6	28.4	10.7	9.0
Réunion (RH)	35.7	28.7	11.1	10.4
Réunion (paratype NM)	35.0	30.0	10.2	9.7
Réunion (RH)	34.5	25.6	10.9	9.8
Réunion (holotype MNHN)	34.4	27.4	10.4	9.7
Réunion, St. Denis (paratype RH)	33.9	27.4	11.6	9.4
Réunion (paratype AMS)	32.8	30.3	10.0	9.6

Table 2. Shell measurements for *Drupa denticulata* n.sp.

RESULTS

Descriptive statistic

The diagrams of the values distribution shows obviously the existence of two distinct groups.

The two dimensional X-Y representation of the ratio studied in pairs are given in Figs 2 and 3.

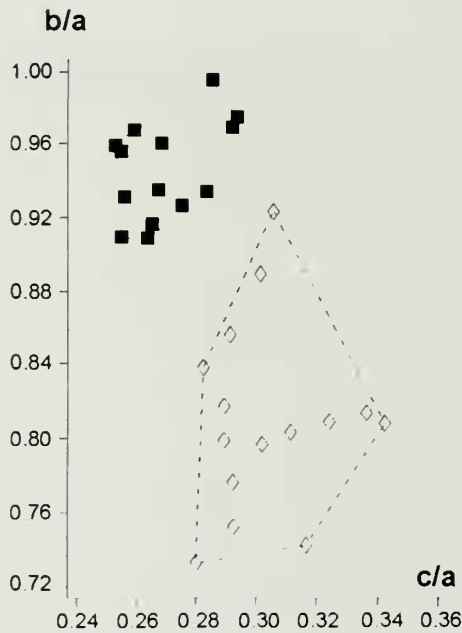


Fig. 2. *Drupa morum morum* (black squares) and *Drupa denticulata* (lozenges). Scatter diagram of c/a vs b/a.

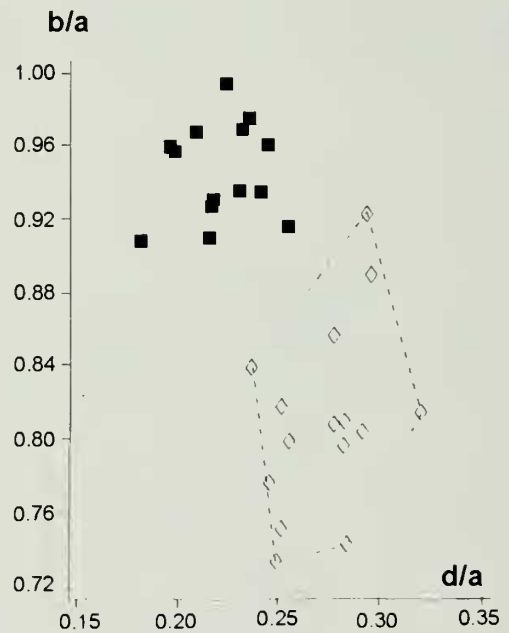


Fig. 3. *Drupa morum morum* (black squares) and *Drupa denticulata* (lozenges). Scatter diagram of d/a vs b/a.

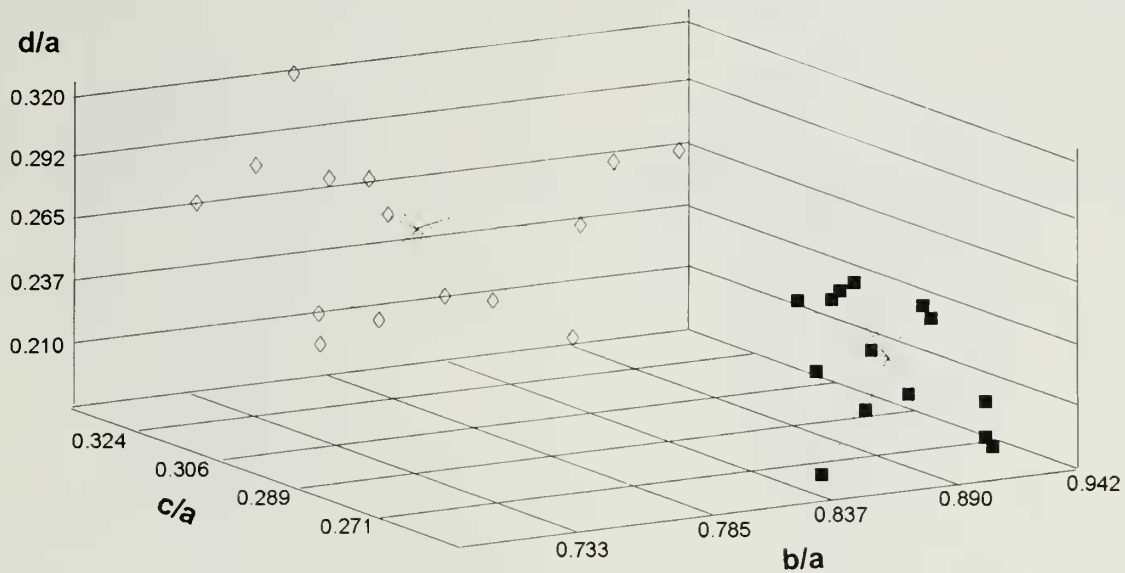


Fig. 4. *Drupa morum morum* (black squares) and *Drupa denticulata* (lozenges). Diagram of d/a vs c/a vs b/a . The different points have been connected to the respective mean of the three ratios for the suspected groups.

The three dimensional diagram illustrated in Fig. 4, built upon the three ratios, clearly evidence the separation of the two groups.

Statistical inference

The comparison test of the means of three ratios for the two groups was built on the study of the sampling distribution of the means difference. The results of the hypothesis tests was that, in the two cases, one can consider that the difference between the means are significant at a level at least equal to 5 percent.

The analysis of variance for the three ratios, treated by the SAS procedure ANOVA, give the following result : the equality of the means hypothesis can therefore be rejected, disregard the significance level (5 or even 0.1 percent), because the probability for a wrong rejecting of the null hypothesis (the "p-value"), corresponding to the degrees of freedom (DF), has a value of 0.0001.

The multivariate analysis, taking account of the three ratios, shows similar results.

Last but not least, the canonical discriminant analysis (SAS CANDISC procedure) fully confirms the total separation of the two groups (Exact Statistic $F= 54.46$, $p= 0.0001$).

CONCLUSION

From an inferential statistical point of view, the tests allow to consider that the difference of the studied quantities, observed for the sample and estimated for the population, is significant.

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Figs 5-10 (opposite page).

- Figs 5-7. *Drupa denticulata* n.sp. 5. Holotype IRSNB IG 28515/477, St. Pierre, Réunion, 32 mm. 6. Paratype MNHN, Réunion, 34.3 mm. 7. Paratype RH, St. Denis, Réunion, 33.8 mm.
- Fig. 8-9. *D. morum morum* Röding, 1798. 8. Thailand, 42 mm, coll. R. Houart. 9. Baie de la Possession, Réunion, 33 mm, coll. R. Houart.
- Fig. 10. *D. morum iodostoma* (Lesson, 1840), Marquesas, 35 mm, coll. R. Houart.

